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and to my opinion in many cases rightly. He criticizes especially that such liberals speak still of Jesus as "redeemer" and "the voice of God to us." Still when Drews himself says, giving his view of religion: "God must become man, so that man can become God, and be redeemed from the bounds of the finite, etc." (p. 296) and when he speaks of "the divine essence of mankind, the immanent Godhead" as "the inner Christ" to be worked out, etc., his phraseology does not differ very much from that of those he criticizes; perhaps after all he does not differ so much in the essential points of religion from those he criticizes. On page 290 he calls the phraseology of a liberal theologian, A. Meyer, concerning God in connection with Jesus, pantheistic. Yet he himself, speaking of "the tidal wave of naturalism, ever growing more powerful and sweeping away the last vestige of religious thought," thinks that "the sinking fire of religion must be transferred to the ground of pantheism in a religion independent of any ecclesiastical guardianship."

The Christ Myth is a good statement of one of the many present theories that Jesus never existed, and we hope that it may find many readers, in order that the actual truth may be probed to the bottom. But just for this reason it would have been desirable that the author in giving the facts on which he bases his theory, would have been less assertive and would have shown that the facts adduced are really well founded.

A. KAMPMEIER.

IOWA CITY.

RIGNANO'S THEORY OF ACQUIRED CHARACTERISTICS

The transmission of acquired characters from parent to child was an old problem in the days before Darwin when the theories of preformism and epigenesis were pitted against each other. Preformism was also called evolution in the narrow and literal sense of the word, for the life of any creature was assumed to be simply an unfolding of the type latent in the germ. A real chicken, though invisible on account of its diminutive size, was supposed to lie hidden in the egg, while the epigenesis theory explained the successive stages of the life in both the race and the individual by additional growth. The discussion of this same problem was renewed by Weismann, who takes a very uncompromising position against Lamarck's view of the development of life through exercise of organs and specialization by use. Weismann denies altogether the inheri-

tance of acquired characteristics. It is commonly considered that the two positions, preformism and epigenesis, are incompatible because contradictory, that if one theory is true the other must necessarily be wrong; but Rignano is confident that he has found a middle ground.

Both parties are agreed that heredity is a kind of memory, and memory is a subject upon which great interest has been concentrated. All recent attempts to bring out the significance of this fundamental factor of organized life are based upon Hering's essay, originally a lecture, "On Memory as a Function of Organized Matter."¹ Among other works in this line we will mention Semon's interesting book entitled "Mneme as the Preservative Principle in the Change of Organic Action,"² and also Rignano's "On the Inheritance of Acquired Characteristics."³

Rignano has been much before the scientific public on account of his new theory of inheritance which he calls centro-epigenesis and which is intended to be a conciliation between preformism and epigenesis. In making the attempt at overbridging the gulf between these two hypotheses, Rignano has worked out his theory with a great mass of detail which renders his book valuable, if for no other reason, as a collection of the most important data and propositions as well as theories proposed on this much mooted subject.

It is noteworthy that Rignano is not originally a biologist but an engineer and has for a large part of his life devoted special attention to physics. This had influenced him in so far as he falls back upon physical allegories of which his comparison of memory to electric currents appears in his conception to be more than a mere comparison.

Rignano is greatly influenced by Weismann whose belief in the isolation of germ plasma he incorporates into his own theory not to its whole extent but only so far as to assume that not the entire germ plasma but only its central zone remains isolated and is therefore stable and not subject to change. This theory of the existence of a stable central zone induces him to call his theory the hypothesis of centro-epigenesis.

It is well known that Weismann tries to explain in this way the rigid stability of heredity. His favorite evidences are found in

¹ Published in an English translation by The Open Court Publishing Co. in 1902.

² *Die Mneme als erhaltendes Prinzip.* Leipsic, Wilhelm Engelmann, 1908.

³ An English translation by Basil Harvey to be published by the Open Court Publishing Company is in preparation.

the beehive and the ant-hill where the queen bee and the queen ant are independent individuals and absolutely separate from the workers. So if a community either of bees or ants changes conditions unsuited for their lives the race would die out if they depended on the transmission of new characters acquired by the workers and not by the queen. Facts compel us to assume that bees and ants do adapt themselves to new conditions, for changes set in in the workers although they can not possibly have been transferred by them upon the queen; and in the same way Weismann believes that the germ cells are independent organs, which cannot be affected by the experience or new acquisitions of the rest of the body, the so-called somatic cells.

Rignano differs from Weismann in assuming that only the central zone of the germ plasma remains stable and continues to consist of the same substance, remaining isolated except for periodic impulses which it gives to somatic life, in this way directing them on to the ontogenetic development of the individual according to the phylogenetic development of the race.

The theory of a central zone is extremely doubtful and it is scarcely probable that further investigations will bear out either assumption, that of a special memory substance which has been deposited after the fashion of galvanic currents, or that heredity is due to the existence of a special germ plasma with a stable and isolated central zone. Rignano's book contains much material of great interest but its value consists not in what he says but in how he says it, for it will certainly stimulate inquiry.

According to our opinion memory is not due to an identity of substance, but to a preservation of form. The same is true of heredity which is a memory transmitted from the parent organism to its offspring, and for the sake of proving the preservation of form in a constant change of substance we must bear in mind that it is characteristic of all life. In order to understand that the race memory is stronger than the memory of a single individual, we have simply to assume that the characteristics of forms, consisting ultimately of millions and millions of generations, are so much stronger than those fewer ones of one generation which we see before us in the parent organism. In fact it stands to reason that the germ plasma representing the innumerable ancestors of the race should be overwhelmingly more vigorous than any amount of characteristics acquired during life. This principle would not exclude that once in a while acquired characteristics can be transmitted, and we may add that they are transmitted

only in cases where the germ plasma of the individual is favorably predisposed for receiving them. In our opinion this proposition would solve the problem of preformism against epigenesis in the simplest and most satisfactory way. At any rate it disposes of the extravagant claim of Weismannism.

Rignano accepts the vaguest part of Weismannism by assuming a bodily identity and isolation of the germ plasma. This hypothesis is the more improbable as all life produces a change of substance, and it seems all but impossible that one part, and in fact the most important part, of an organism should remain isolated, stable and unchanged. Rignano escapes some of the difficulties of Weismann by reducing the isolation of the germ plasma and conceiving it only as relatively stable.

Rignano declares that both preformism and epigenesis are untenable in their extreme forms, and that though both theories are commonly assumed to exclude one another each contains in its way an important truth. In his defence of preformism Rignano falls back again on Roux who by extirpation produced half-embryos and created otherwise perfect organisms which only lack definite organs. These experiments allow no other interpretation than that definite portions of the germ are preformed.

The explanation of memory as due to a preservation of form seems not only simpler but more probable than any other hypothesis which is based upon mere assumption. The stability of form preserved in the flux of sentient substance is no less persevering than the stability of a substance which in living organisms is, to say the least, very improbable.

Rignano argues that since the organs of an organism are always in equilibrium they cannot cause the changes of a further development. Therefore he accepts the conclusion that there must be a special zone of substance which remains constant and unchanged during the development of the individual, and that this zone sends out the stimuli which dominate the progress of organisms from stage to stage. Finally he identifies this central zone with Weismann's germ plasma which represents the phylogenetic factors and remains separate from the ontogenetic fate of the individual. But Rignano differs from Weismann by assuming that not the whole germ plasma but only its center remains isolated, which isolation, however, does not exclude that from time to time it sends out impulses and effects the individual somatic conditions without being reacted upon. This is claimed to explain the several facts which

have troubled biologists, both the preformists and the believers in epigenesis.

Rignano finds a proof of his theory in Roux's experiments of post-generation. The salamander's amputated feet grow again, so do the lenses of the triton's eyes, which indicates that the factor of generation does not lie in the destroyed organs but has its source in some other part of the body according to Weismann, the germ plasma.

Rignano, having devoted much of his thought to physics, falls back upon a physical explanation of memory which in our opinion is rather unfortunate. Instead of regarding memory as a preservation of forms in sentient substance he compares the nervous activity to the currents of accumulators, which deposit a substance capable of reproducing the same current. A discharge can take place only if resistance is sufficiently weak. Thereby Rignano explains how the different nervous currents of ontogenesis follow each other in the definite succession of their phylogenesis. Every nervous current reproduces the analogous state of evolution which the discharge of the accumulated elements render possible. These considerations induce Rignano to explain the phenomena of memory as resting on the same foundation. The nervous current which corresponds to a definite sensation also deposits a specific substance, which later on reproduces an analogous nervous process and with it an analogous elements of consciousness. This reproduction actually takes place if the resistance to a discharge is sufficiently weak, which means that the former nervous situation repeats itself in the same or partly the same way.

Mr. Rignano writes in a private letter to the author: "Naturally what interested me more than all is what you say concerning biological memory, and you have understood perfectly that the basis of memory resides in the anabolic processes of a restoration of living substance. A little step further and you will perceive memory as a process of specific accumulation, which means that this conception of memory is an accumulation of energy. The transition of it from a potential to an actual state constitutes what is called mnemonic evocation, which seems preferable to the old conception of memory as a trace. This becomes evident in my article on 'The Mnemonic Origin and Mnemonic Nature of Affective Tendencies,' for every one admits that these affective tendencies are only accumulations of energy, and if they are of a mnemonic origin it means that the

mnemonic phenomenon itself is also in its essence only a phenomenon of accumulation."

It is possible that the old view of memory conceived as a trace may have been insufficient, and may have interpreted it as a dead inactive impression like that of a seal, but a careful consideration of the facts will show that form is the indispensable and most important feature in the preservation of memory. As I conceive the nature of memory it is a form, not only of substance, but also of energy. Whatever energy may be stored up, the character of energy, its significance, its meaning, does not depend on any kind of force, be it electrical, or vital or mechanical but on the form of force, which again is dependent upon the impression preserved in the brain substance.

It has been my endeavor to bring out the all-importance of form, which theory becomes most apparent in biology.

Rignano's explanation of the way in which the germ plasma reproduces the succession of specific nervous currents which have been produced by phylogenesis appears to me somewhat stilted and could be greatly simplified by seeking the cause of memory purely in form and not in a specific substance deposited by a kind of nervous accumulator.

There is a third hypothesis proposed by Rignano which conceives the life process, especially assimilation, as "an internuclear oscillating nervous discharge," but Rignano himself considers the proposition a bold one and points out that the two other hypotheses are independent of the third. His work in this line is more tentative than safe in its constructions and we may add that in all his labors his criticism is the most valuable part of his work. Rignano is well read in the literature of his subject, perhaps more so than others, for the horizon of specialists is often limited to the publications that appear in their own native language. Rignano's book bristles with references to facts and experiments of great significance, and this feature of his labors alone would render his presentation both instructive and stimulating whether or not his two main theories are right.

P. C.

ECCENTRIC LITERATURE.

The authors of eccentric literature are usually cranks or mattoids.¹

¹ The term "mattoid" is preferable, to "crank," which is misused.